Prevalence, Severity and Related Factors of Dental Caries in School Going Children of Vadodara City – An Epidemiological Study

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ABSTRACT

Objective: Among dental diseases, dental caries is an important dental public health problem in India which is irreversible in nature, and is predominantly a disease of childhood. Till date no study has been carried out in Vadodara. As baseline data of caries is required to improve oral health of children, the present study was undertaken to determine the pattern of dental caries in school children of Vadodara city in the mixed dentition period considering age, sex and dietary patterns.

Method: An epidemiological cross sectional descriptive study was carried out among 1600 school children aged 6-12 years in Vadodara city. A closed ended questionnaire according to World Health Organisation 1997 methodology was used to collect the data. The children were examined for the presence of dental caries using decayed missing filled teeth/decayed missing filled surfaces and Decayed Missing Filled Teeth/Decayed Missing Filled Surfaces index. Related factors which predispose caries such as age, sex and dietary patterns were recorded.

Results: The prevalence of dental caries was 69.12%. The mean dmft/dmfs and DMFT/DMFS were 3.00/4.79 and 0.45/0.56 respectively. The prevalence was higher in deciduous teeth than in permanent teeth. Positive association was found between dental caries and age, sex, frequency of sugar consumption in between meals.

Conclusion: The study concludes that the prevalence and severity of dental caries in Vadodara city is high. So, in developing country like India, it is imperative to introduce primary prevention and increased restorative care for the purpose of both reducing the caries prevalence and maintaining those caries free children.

Key Words: Epidemiology, Dental Caries, Prevalence, Severity, Risk Factors, Odd's Ratio.

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INTRODUCTION

In a developing country like India, dental caries still exists as a smoldering disease that has engrossed its tentacles deep into those regions where there are inadequate resources for dental treatment, lack of public awareness and motivation and increase in the consumption of the sugar.[1]

Voluminous dental literature exists about dental caries levels in the Indian population. The overall impression is that dental caries has increased in prevalence and severity over the last couple of decades.[2] Preventive approaches seems to be a viable alternative to tackle the seemingly overwhelming problem of dental caries. However data necessary to plan such a preventive measure is found lacking.

During mixed dentition period oral hygiene is poor because of care free age, emotional stresses of the child, frequent intake of refined sugars, soft and sticky foods, shedding of deciduous and eruption of permanent teeth. But this period is considered as the critical stage from the point of view of development of normal occlusion, preservation of permanent first molar from hazards of dental caries is one of the most important responsibilities of the profession.[3] So, this epidemiological study was planned in school going children of Vadodara city with the following aim and objectives:

- To assess the prevalence and severity of dental caries in 6 to 12 years old school children of Vadodara city.
- To determine the age at which the children are most susceptible to dental caries in mixed dentition period.
- To find the relation between sugar consumption and dental caries.
- To provide base line data for planning of dental services in Vadodara city.

MATERIALS AND METHODS

An epidemiological cross sectional descriptive study was carried out among 1600 school children aged 6-12
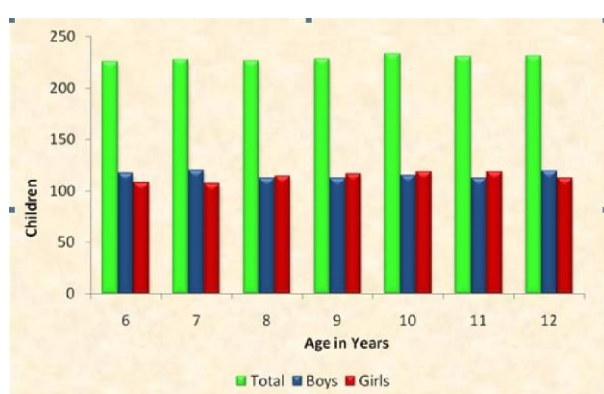

Fig. 1: Distribution of Sample Size

years in Vadodara city. Multistage sampling technique was used. The city was divided into five zones and from each zone two schools were selected randomly using simple random sampling method (lottery method). Permission was obtained from concerned authorities of respective schools and Ethical Committee of Sumandeep Vidyapeeth University, then informed written consent was taken from the parents before examining children. Stratified random sampling technique was used to select children excluding Subjects who were physically or mentally challenged, medically compromised or with gross dental / orofacial defects like cleft lip or cleft palate.

A closed ended questionnaire according to WHO 1997 methodology[4] was used to collect the data. Before conducting survey all the examiners were calibrated at department of Pedodontics and Preventive Dentistry, K.M. Shah Dental College & Hospital, Vadodara under the guidance of a Professor in order to limit examiner variability. The children were examined according to ADA type III examination technique[5] for the presence of dental caries using dmft/dmfs and DMFT/DMFS index. Related factors which predispose caries such as age, sex and dietary patterns were recorded.

Data was entered in Microsoft excel and analyzed using SPSS (version 12). Qualitative data was presented as frequency and percentages. The results were subjected to statistical analysis using prevalence test, chi-square test, Pearson's correlation coefficient and bivariate dfgodd's ratio. For all tests the level of significance was set at $p \leq 0.05$.

RESULTS

The data obtained from the study was subjected to statistical analysis. The results are presented under the headings of various parameters considered for the study.

Figure 1 shows distribution of sample according to age and gender. Total sample size comprised of 1600 students, with 807 boys and 793 girls almost equally distributed in each age group.

Total dental caries prevalence was 69.12% with higher prevalence in boys (70.01%) than in girls (68.22%) which was not statistically significant. There was highly significant relation (p ≤0.0001) between age and
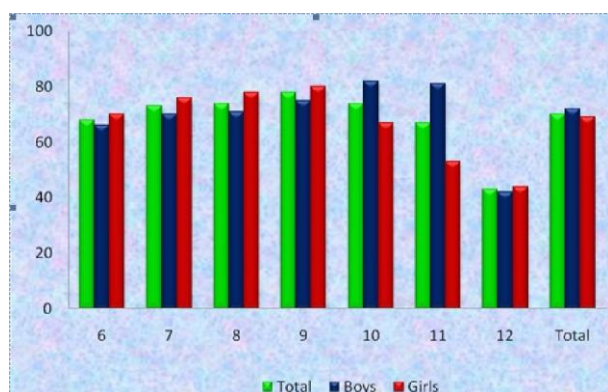
Fig. 2: Distribution of Children According to Age and Gender with Respect to Prevalence of Dental Caries in Deciduous Dentitio.
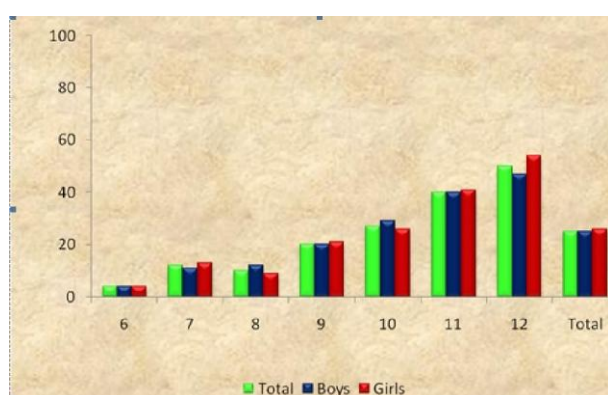

Fig. 3: Distribution of Children According to Age and Gender with Respect to Prevalence of Dental Caries in Permanent Dentitio
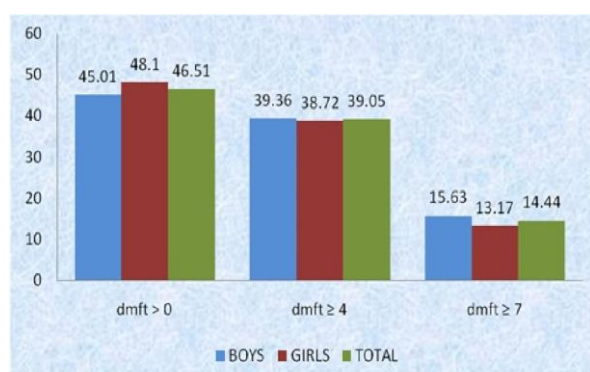

Fig. 4: Distribution of Children According to Severity of Dental Caries in Deciduous Dentition.

prevalence of caries as shown in **Table 1**. In deciduous teeth, the caries prevalence was 70% as given in **Figure 2** whereas in permanent teeth the caries prevalence was 25% depicted in **Figure 3**.
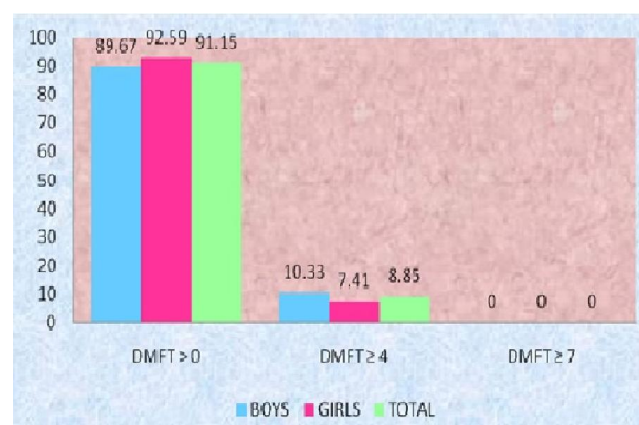
Fig. 5: Distribution of Children According to Severity of Dental Caries in Permanent Dentition.
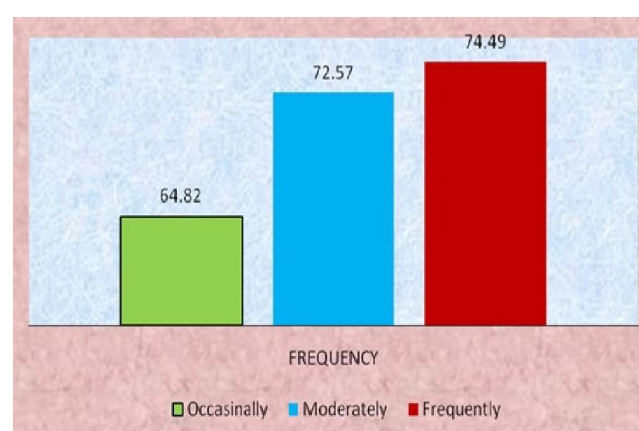
Fig. 6: Distribution of Children According to Frequency of Sugar Consumption in Between Meal and Dental Caries Status.

In total sample, the mean dmft was 3.00 **(Table 2)** and mean dmfs was 4.79 **(Table 3)** respectively. The mean DMFT was 0.45 **(Table 4)** and mean DMFS was 0.56 **(Table 5)** respectively.

Figure 4 reveals distribution of children according to severity of dental caries in deciduous dentition. Low severity (dmft>0) of caries was observed in 46.51% children, Moderate severity (dmft≥4) was observed in 39.05% children and High severity (dmft≥7) was observed in 14.44% children suggesting low to moderate severity of caries in majority of children.

Figure 5 depicts distribution of children according to severity of dental caries in permanent dentition. 91.15% children had low severity (DMFT>0) of caries, 8.85% children had moderate severity (DMFT≥4) and no child

Table 1: Distribution of Children According to Age and Gender with Respect to Prevalence of Dental Caries.				
Age	Children Examined	Children with Caries (%)	Boys n (%)	Girls n (%)
6	225	153 (68)	77 (65.81)	76 (70.37)
7	227	165 (72.69)	84 (70)	81 (75.70)
8	226	168 (74.33)	79 (70.54)	89 (78.07)
9	228	177 (77.63)	84 (75)	93 (80.17)
10	233	173 (74.24)	94(81.74)	79 (66.95)
11	230	154 (66.95)	91 (81.25)	63 (53.39)
12	231	116 (50.21)	56 (47.06)	60 (53.57)
Total	**1600**	**1106 (69.12)**	**565 (70.01)**	**541 (68.22)**
Chi-square=54.16, df=6, p < 0.0001, HS			Chi-square=0.6, df=1,p > 0.05, NS	

Table 2: Distribution of Children According to Age and Gender with Respect to Mean dmft in Deciduous Dentition.						
	Mean dmft ± S. D.					
Age	Total		Boys		Girls	
	Mean dmft	S. D.	Mean dmft	S. D.	Mean dmft	S. D.
6	3.46	2.12	3.55	2.23	3.37	2.43
7	3.58	2.05	3.56	2.33	3.59	2.37
8	3.19	2.43	3.25	2.52	3.12	2.09
9	3.29	2.02	3.24	2.09	3.34	2.60
10	2.95	1.76	3.19	2.00	2.72	1.42
11	2.02	1.00	2.59	1.06	1.47	0.78
12	1.93	0.92	1.98	0.79	1.86	0.87
Total	**3.00**	**1.90**	**3.15**	**1.96**	**2.85**	**1.29**

Table 3: Distribution of Children According to Age and Gender with Respect to Mean dmfs in Deciduous Dentition.						
	Mean dmft ± S. D.					
Age	Total		Boys		Girls	
	Mean dmfs	S. D.	Mean dmfs	S. D.	Mean dmfs	S. D.
6	5.16	3.65	5.23	3.47	5.0	3.23
7	5.63	3.09	5.87	3.74	5.37	3.48
8	4.88	2.56	4.98	2.88	4.79	2.51
9	5.54	3.18	5.46	3.00	5.63	3.67
10	5.08	2.99	5.34	3.23	4.32	2.61
11	3.32	1.87	3.96	2.00	2.71	1.24
12	2.81	0.96	2.84	0.89	2.78	1.21
Total	**4.79**	**3.12**	**5.0**	**3.76**	**4.52**	**2.83**
Correlation co-efficient for dmft & dmfs – 0.95, p - < 0.0001, HS						

Table 4: Distribution of Children According to Age and Gender with Respect to Mean DMFT in Permanent Dentition						
Age	**Mean DMFT ± S. D.**					
	Total		**Boys**		**Girls**	
	Mean DMFT	**S. D.**	**Mean DMFT**	**S. D.**	**Mean DMFT**	**S. D.**
6	0.05	0.03	0.06	0.02	0.04	0.02
7	0.11	0.09	0.08	0.04	0.16	0.06
8	0.14	0.1	0.14	0.08	0.13	0.08
9	0.29	0.17	0.29	0.12	0.27	0.12
10	0.49	0.28	0.45	0.23	0.52	0.24
11	0.73	0.36	0.78	0.34	0.67	0.34
12	1.1	0.75	1.06	0.67	1.15	0.64
Total	**0.45**	**0.23**	**0.44**	**0.21**	**0.46**	**0.24**

Table 5: Distribution of Children According to Age and Gender with Respect to Mean DMFS in Permanent Dentition						
Age	**Mean DMFS ± S. D.**					
	Total		**Boys**		**Girls**	
	Mean DMFS	**S. D.**	**Mean DMFS**	**S. D.**	**Mean DMFS**	**S. D.**
6	0.05	0.02	0.05	0.02	0.04	0.02
7	0.15	0.09	0.1	0.05	0.2	0.08
8	0.15	0.08	0.15	0.08	0.15	0.06
9	0.37	0.23	0.36	0.13	0.39	0.18
10	0.58	0.3	0.55	0.32	0.62	0.29
11	0.91	0.54	1.00	0.47	0.83	0.47
12	1.42	0.81	1.35	0.61	1.47	0.86
Total	**0.56**	**0.27**	**0.55**	**0.28**	**0.58**	**0.30**
Correlation co-efficient for DMFT & DMFS – 0.99, p - < 0.0001, HS						

Table 6: Bivariate Odd's Ratio for Caries on Deciduous Dentition. The Dependent Variables – dmft was dichotomized (dmft=0 versus dmft>0)		
Variable	**Odd's ratio (CI 95%)**	**P value**
Sugar consumption Yes, no	0.15 (0.07 – 0.34)	<0.001*
Frequency of sugar consumption Occasionally, frequently	0.46 (0.33 – 0.65)	<0.001*
* Significant at 5% level of significance (p<0.05)		

(0%) had high severity (DMFT≥7) indicating low severity of caries in majority of children.

Figure 6 shows relation between frequency of sugar intake between meals and dental caries. It was found that as the frequency of sugar consumption between meals increased the dental caries prevalence also increased. It implies a very significant positive

correlation between frequency of sugar consumption between meals and dental caries.

Table 6 shows results of bivariate odd's ratio for caries on primary dentition. In present study when bivariate analysis was applied; the possibility of caries was more in children who consumed sugar between meals (OR = 0.15; 95% CI = 0.07-0.34) and frequency of sugar consumption between meals was positively associated with caries (OR = 0.46; 95% CI = 0.33-0.65).

Table 7 shows results of bivariate odd's ratio for caries on permanent dentition. The children who consumed sugar between meals were more likely to have caries (OR = 0.47; 95% CI = 0.09-2.28) and frequency of sugar consumption between meals was positively associated with caries experience (OR = 0.6; 95% CI = 0.44-0.81).

Damle & Patel[14] (1994), Rao et al[15] (1999), Joshi N[10] (2005) and higher than Misra and Shee[9] (1979), Chopra et al[3] (1983), Mahesh P et al[8] (2005), Jain A et al[16] (2005), and Lina Naomi et al[17] (2006).

In present study boys showed higher caries prevalence than girls. Similar findings were reported by Ram Prasad Vaish[18] (1983), Mahesh P et al[8] (2005), Rao et al[15] (1999), Saravanan et al[2] (2004), Jain A et al[16] (2005). The increased prevalence in boys confirms the view that there is a marked preference for sons regardless of the socio-economic class, which manifests itself in the longer feeding of sons compared to daughters. It also may be due to their habits of taking soft drinks and other sweetened snacks during their longer outside stay. These results are not supported by Misra and Shee[9] (1979) as they found higher prevalence in girls than in boys.

Table 7: Bivariate Odd's Ratio for Caries on Permanent Dentition. The Dependent Variables – DMFT was dichotomized (DMFT=0 versus DMFT>0)		
Variable	**Odd's ratio (CI 95%)**	**P value**
Sugar consumption Yes, no	0.47 (0.09-2.28)	0.3
Frequency of sugar consumption Occasionally, frequently	0.6 (0.44-0.81)	0.001*
* Significant at 5% level of significance (p<0.05)		

DISCUSSION:

Caries prevalence varies from country to country and from region to region in same country. Geographic variables like race, climate, diet, culture and economic factors also affect the caries prevalence. In spite of these variations an attempt has been made to compare the findings of present study with the other studies within and outside the country.

Voluminous literature exists on the status of dental caries in the Indian school children by different investigators e.g. Vaish Ram Prasad[6] (1982), Nagaraja Rao[7] (1985), Maheshkumar P et al[8] (2005), Misra & Shee[9] (1999), Joshi N[10] (2005) and Gauba et al[11] (2007) etc. Hence review of the past data for caries and prediction of the future is the need of the hour[12]

The present study showed caries prevalence of 69.12% in 6 to 12 years old children. The prevalence is similar to study done by Retnakumari N.[13] (1999), lower than

In the present study caries prevalence increased as the age increased from 6 years to 9 years and then decreased with lowest being at age of 12 years. The results are supported by Misra and Shee[9] (1979), Ram Prasad Vaish[18] (1983), Mahesh P et al[8] (2005), Rao et al[15] (1999). This is because of longer exposure of primary molars in 8-10 years of age. After that there is exfoliation of these teeth and eruption of permanent teeth occur which have lower susceptibility to dental caries and not exposed to the factors responsible for caries for a longer time. Another reason is improper cleaning of teeth in early childhood and frequent intake of carbohydrate rich and sticky foods. These findings are contradictory to the study done by Retnakumari N[13] (1999)

The said study showed higher caries prevalence in primary teeth than in permanent teeth. This could be attributed to the fact that the permanent teeth have a lower susceptibility to dental caries. It may also be due

to the lower calcium content and structural differences in primary teeth (Vaish R. P.)[6].

The caries prevalence in primary teeth was higher in boys than the girls. This may be attributed to the fact that boys are given more importance than girls in Asia societies (Shanti Gosh 1986)[19]. The caries prevalence in primary teeth increased from 6 years to 9 years of age and then decreased with lowest being at 12 years age. This may be that by 12 years most of the primary teeth exfoliate.

In permanent teeth, the girls showed more prevalence than the boys. This may be due to the fact that in girls the permanent teeth erupt earlier than the boys and therefore they are exposed to the oral environment for a longer time. (Megas B. F. et al 1989)[20]. The caries prevalence showed steady increase from 6 years to 12 years, with highest being at 12 years in this study. The similar findings are reported by Retnakumari N[21] (1999), Bhaskar et al[22] (2000) and Saravanan et al[2] (2004).

The mean dmft values in present study were higher than the values obtained from the studies of Chopra et al[3] (1983), I. Ahtanassouli et al[23] (1991), Ratnakumari N[13] (1999) and Gopinath[24] (1999) while they were lower than the studies of Villalobos JJ et al[25] (2006) and Gauba et al[11] (2007).

The mean DMFT values in present study were lower than the values obtained from studies of Chopra et al[3] (1983), I. Ahtanassouli et al[23] (1991), Ratnakumari N[13] (1999), Villalobos JJ et al[25] (2006) and Gauba et al[11] (2007) while they were equal to studies of Bhaskar et al[22] (2000) and Lina Naomi et al[17] (2006).

The mean counts of dmfs and DMFS in the present study were lower than reported by Navin Shetty & Shobha Tandon[26] (1988), J. A. Hargreaves et al[27] (1996), I.M. Jamieson[28] (2004) and Gauba et al[11] (2007). The variations in the prevalence could be related to racial, climatic, dietary, cultural and economic conditions.

In deciduous teeth, the results of this study are similar to the findings of Peres MA et al[29] (2006), Villalobos et al[25] (2006) but differs from the findings of Retnakumari N[13] (1999) who observed high severity of caries in majority of children.

In permanent teeth no child showed high severity of caries, majority of children showed low severity. The findings of this study are supported by Villalobos et

al[25] (2006), Carlo Medina et al[30] (2007) and T Mello et al[13] (2008).

The food habits play an important role in the causation of dental caries. The introduction of refined sugar (sucrose) into the modern diet has been associated with the increased caries prevalence. Since the time of early Greek philosophers diet has been suspected of influencing the etiology of caries. The direct relation of frequency of sweet, sticky snacks and dental caries incidence has been proved by Gustaffson[31] (1954) in Vipehome study.

To study the association between the sugar in diet and dental caries the children were divided into three groups depending upon the total number of sugar exposures/day i.e. Frequently (more than 4 sugar exposures/day), Moderately (2-3 sugar exposures/day) and Occasionally (1sugar exposure/day). However the reliability and accuracy of such an anamnestic history for measuring the contribution of diet to prevalence of caries is questionable. In spite of these factors an effort was made to find the relation between sweet consumption and dental caries.

The findings of this study showed considerably higher caries prevalence in sweet eating group compared to those who did not eat sweets. A direct association was observed between the frequency of sugar consumption and dental caries. The findings of present study reconfirm the importance of sugar (sucrose) as one of the prime etiological factors which are consistent with the findings of Winter and Rule[32] (1971), Shetty and Tandon[26] (1988), Gupta A et al[33] (1988), Kalsbeek and Verrips[34] (1994) and Szpunar S[35] (1995). However, McDonald and Weisenbach M[36] (1995) found no significant relationship between sugar consumption and caries prevalence.

CONCLUSION

It is concluded that the prevalence and severity of dental caries in the present study is on the higher side, with more decayed than filled teeth.

The results of this baseline study indicate the dental caries is a major public health problem and lack of preventive and restorative dental care facilities as well as awareness among population in this region. Results make it imperative to introduce primary prevention and increased restorative care for the purpose of both

reducing the caries prevalence and maintaining those caries free children as the ultimate goal is to produce a caries free childhood.

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